



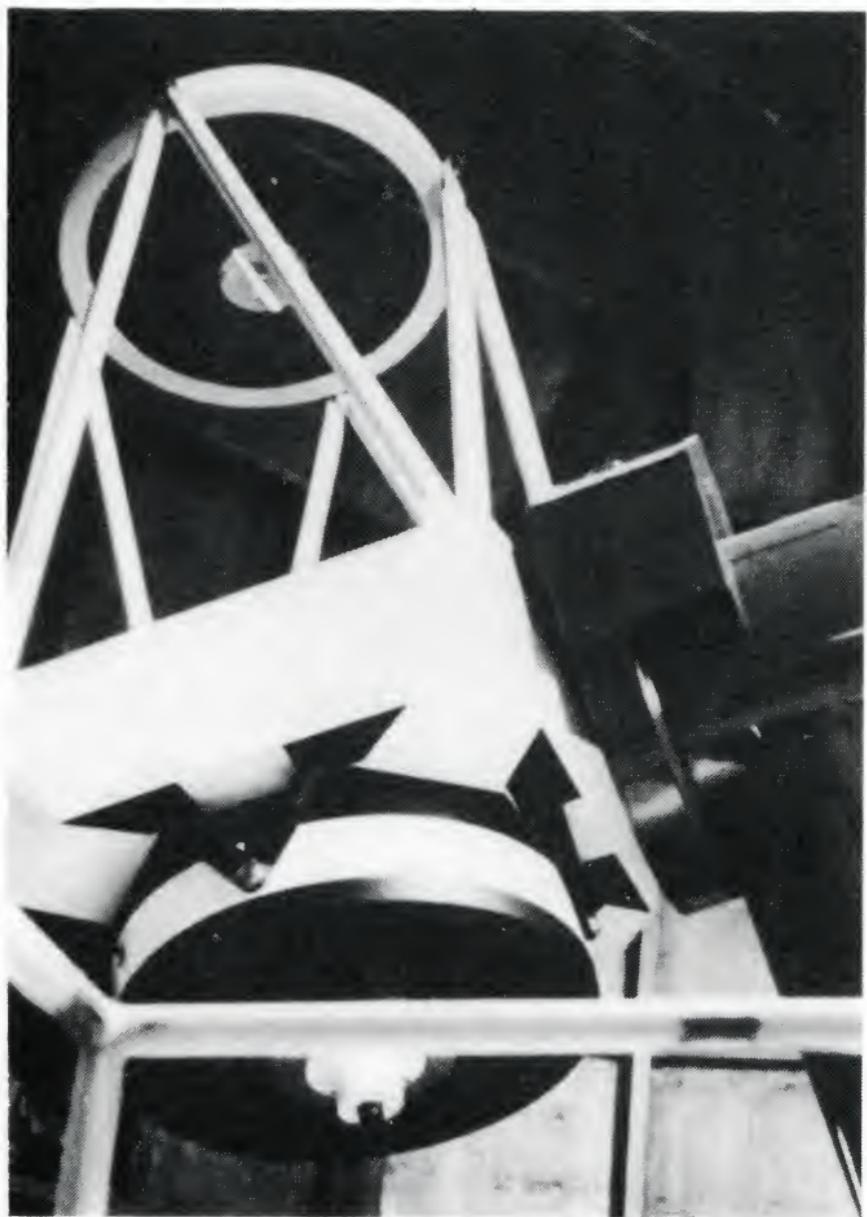
# **Mount John University Observatory**

**Lake Tekapo, New Zealand**

**Operated by:**

**Department of Physics and Astronomy  
University of Canterbury  
Christchurch, New Zealand**

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**Figure captions:**

**Front cover:** The Large Magellanic Cloud: Mt John *Canterbury Sky Atlas* picture.

**Above:** The McLellan 1m telescope at Mt John University Observatory.

# 1 Mt John University Observatory

Mt John University Observatory is situated on Mt John, a hill rising 300 metres above Lake Tekapo in the Mackenzie Basin of South Canterbury. It is operated by the Department of Physics and Astronomy of the University of Canterbury, Christchurch. The observatory is 240 km by road from Christchurch. Astronomers from the observatory, the Department, from other research institutions in New Zealand and occasionally from overseas use the facilities to undertake research in a variety of areas of astronomy and astrophysics. The information gained contributes to fundamental knowledge of stars and other celestial objects. The observatory also serves as an important facility for training graduate students who undertake research programmes in astronomy.

The observatory was founded in 1965 originally with the participation of the University of Pennsylvania in the United States. Mt John was selected as the best observing site in New Zealand following a site survey conducted between 1961 and 1963. Among its advantages for astronomical work are the large number of clear nights (by New Zealand standards), its remoteness from bright city lights, the transparency and steadiness of the air, and the site's proximity to roading and electricity. The mountains surrounding the Mackenzie Basin act as barriers stopping much cloudy weather from both the east and west.

Until 1983 the observatory shared the hill-top with a satellite tracking station. After that facility was closed, the building was acquired by the University and following extensive modifications, it is now used to house the 1m-aperture telescope which was designed and constructed by the Department of Physics and Astronomy. This instrument was installed on Mt John in 1986 and named the McLellan Telescope after a former head of the Department and Professor of Physics. The observatory also has two smaller reflecting telescopes of 61cm aperture, which were installed in 1970 and 1975. These

three telescopes are the most powerful in New Zealand. The observatory also has several astronomical cameras, or astrographs, the largest being of 25 cm aperture.

## 2 Research activities

A variety of research is carried out with the telescopes and cameras on Mt John.

**Photometry** – the precise measurement of the brightness and colour of stars. Particular interests at Mt John are pulsating variable stars and eclipsing binary stars. Pulsating variables include Cepheids which show regular brightness and spectral changes as they pulsate in and out on timescales of days to weeks. Eclipsing binaries are close pairs of stars appearing as one in the telescope. As the stars orbit each other they alternately eclipse one another, and so the combined light of the two stars fades and brightens. Measurements of the changing brightness allow the sizes, temperatures and many other details of such stars to be determined. Another type of variable star observed at Mt John includes rotating stars with non-uniformly spotted surfaces.

**Spectroscopy** – the analysis of the light from a star to determine its chemical composition, temperature, surface gravity, rotation rate, movement towards or away from us and many other properties. The light is broken down into its component colours or wavelengths by means of a spectrograph before being recorded.

The information from spectroscopy and photometry can be used not only to understand an individual star but to develop ideas about our Galaxy as a whole. Our Galaxy, the Milky Way, consists of approximately one hundred billion ( $10^{11}$ ) stars in a region with a diameter of about 100 000 light years (1 light year is about  $10^{13}$  km).

**Astrometry** – the precise measurement of the positions of comets and asteroids (minor planets) in the solar system against the background of stars. From these observations the orbital characteristics of these small bodies that move around the Sun can be determined. This information has for example allowed spacecraft to rendez-vous with asteroids on two occasions. In addition several asteroids and a comet have been discovered by Mt John observers.

Though the telescopes on Mt John are small by international standards, the observatory is able to make a very useful contribution to international science. The observatory is one of the southernmost professional observatories in the world. At 44° south certain important southern objects stay in view all year round. For example the exceptional naked eye supernova (a kind of exploding star) in February 1987 was observed from Mt John during the following 15 months as it slowly faded; it was located in the satellite galaxy to the Milky Way known as the Large Magellanic Cloud, which can be readily seen from Mt John during all seasons of the year.

### **3 Instruments at Mt John**

The astronomers at Mt John use a complex variety of spectrographs, photometers and cameras to make their observations. The telescopes can be set using television cameras and the data recorded with sensitive light detectors such as photomultipliers, diode arrays or charge-coupled devices. The signal produced by the light from a distant star can then be converted to a series of numbers which is recorded and later analysed by computer.

Mt John has two spectrographs, and two photoelectric photometers as well as a CCD camera for faint-object photometry. One of the spectrographs is used for high resolution spectroscopy on bright stars, the other for less detailed observations of fainter objects. Most of the instruments at

Mt John were designed and built in the workshops of the Department of Physics and Astronomy.

## **4 Staff at Mt John and in the Department of Physics and Astronomy**

At Mt John there are four resident staff, including three observers and one maintenance technician. One of the observers is also the observatory superintendent (M. Clark). Three academic astronomers at the University of Canterbury together with their graduate students are the principal research scientists making use of Mt John. Visiting observers regularly come from the Carter Observatory, Wellington, the Victoria University of Wellington and from overseas institutions.

Director:

Dr R.W.G.Syme

Academic staff (Christchurch):

Drs J.B.Hearnshaw, P.L.Cottrell, W.Tobin

Technical staff (Mt John):

M.Clark, E.J.A.Baker, A.C.Gilmore,  
P.M.Kilmartin

Technical staff (Christchurch):

G.M.Kershaw, R.A.Ritchie

## **5 Tours and Facilities**

Weather permitting, daytime tours of the Observatory can be arranged if staff are available. These tours are restricted to the period Monday to Friday, October to May. They must be booked in advance with the Superintendent (Telephone: (03) 680 6813). Tours usually begin at 1 p.m. and take about one hour. Buses are not allowed on our mountain road as they can cause damage to the road surface. The private access road is closed to all visitors, except those with appointments. No picnic or public toilet facilities are available on the mountain top.

## 6 Astronomy amongst the Sciences

Astronomy is one of the oldest of the sciences. For thousands of years man has been using the objects in the sky for many purposes (for example: navigation, time measurements and agriculture).

Today when astronomers observe stars and galaxies in the sky using spectroscopic, photometric and astrometric techniques they are acquiring data which will help us to understand the physical processes operating in the universe. This is part of our long quest to piece together a giant jigsaw puzzle of the overall structure of the universe, and its ever-changing nature.

Astronomers are providing information about objects as near as those in the Solar System, using space probes (such as the Voyager missions to Jupiter, Saturn and beyond), and as distant as the edge of the observable universe, where the light that we receive on Earth today left these objects about ten billion years ago.

All of this work would not have been possible without the development of much new technology. This extends from Galileo's use of the telescope for astronomical observations in 1609, through to the construction and use of the 5m telescope at Mt Palomar beginning in 1944, to the Hubble Space Telescope which was launched into Earth orbit from the Space Shuttle in 1990. Our Observatory at Mt John forms part of an extensive network of observatories around the world.

## 7 Contact addresses:

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### Lake Tekapo area

